REMARKS

I. Status of the Application

Claims 8-27 are pending in this application. In the July 13, 2009 office action, the Examiner:

A. Rejected claims 11 and 12 under 35 U.S.C. §112, second paragraph, as allegedly being indefinite;

B. Rejected claims 16 and 17 under 35 U.S.C. §103(a), as allegedly being unpatentable over U.S. Patent No. 6,175,551 to Awater et al. (hereinafter "Awater");

C. Rejected claims 8 and 9 under 35 U.S.C. §103(a), as being unpatentable over Awater in view of U.S. Patent No. 6,529,925 to Schenk (hereinafter "Schenk");

D. Rejected claims 10-15 under 35 U.S.C. §103(a), as allegedly being unpatentable over Awater and Schenk and further in view of the Henkel et al. article, "PAR reduction revisited: an extension of Tellado's method" (hereinafter "Henkel"); and

E. Rejected claims 18-27 under 35 U.S.C. §103(a), as allegedly being unpatentable over Awater in view of Henkel.

In this response, applicants have amended claims 8, 11-14, 16, 21 and 23, and have cancelled claims 9, 10, 15, 20 and 24-27, without prejudice. Applicants respectfully traverse the prior art rejections of the claims and request reconsideration in light of the foregoing amendments and accompanying remarks.

II. The Indefiniteness Rejection of Claims 11 and 12

The Examiner has rejected claims 11 and 12 as allegedly being indefinite. In particular, the Examiner asserted that the term "and/or" is indefinite. Applicants respectfully traverse. The term "and/or" has a defined meaning and does not render the scope of the claims unduly difficult to determine. The term "and/or" between two objects means one or the other, or a combination of both. The claim term is not ambiguous in its meaning, nor is the claim ambiguous.

Nevertheless, claims 11 and 12 have been amended to recite the same feature while avoiding the specific term "and/or". In light of the amendments to claims 11 and 12, it is respectfully submitted that the indefiniteness rejection should be withdrawn.

III. Obviousness Rejection of Claim 8

Claim 8 stands rejected as allegedly being rendered obvious over Awater in view of Schenk. Claim 8 has been amended to incorporate the limitations of claims 10 and 15. Claims 10 and 15 stand rejected as allegedly being obvious over Awater in view of Schenk further in view of Henkel. As will be discussed below in detail, there is no legally sufficient motivation or suggestion to modify Awater with the teachings of Schenk and Henkel as proposed by the Examiner. As a consequence, it is respectfully submitted that the obviousness rejection of claim 8, as amended, should be withdrawn.

A. Present Invention

Claim 8, as amended, is directed to a method for reducing the crest factor of a data symbol to be transmitted in a multi-carrier data transmission system. The data symbol is a function of a plurality of signals provided within a predetermined data frame, each of the plurality of signals allocated to a carrier, each carrier occupying at least one frequency from a transmit data spectrum. At least one carrier is reserved which is not provided for the data transmission. The method includes receiving the predetermined data frame, the predetermined data frame exhibiting the data symbol and a cyclic prefix which is derived from a part of the data symbol, and performing crest factor reduction corresponding to the predetermined data frame based at least in part on peak values within the cyclic prefix of the predetermined data frame.

As amended, the crest factor reduction is performed by (a) filtering the data symbol and the cyclic prefix, (b) determining whether a time-domain function of the data symbol and of the cyclic prefix within the predetermined data frame exhibits at least one peak value that exceeds a first threshold, (c) determining an amplitude of an exhibited peak value and an associated position within the predetermined data frame, (d) generating a correction function by scaling and transposing a sample correction function in dependence on the amplitude and associated position of the exhibited peak vale, using the at least one carrier which is not available for data transmission for generating the sample correction function in the time domain, and (e) modifying the data symbol to be transmitted by superimposing the correction function.

B. Awater

Awater is directed to a system for reducing the peak-to-average factor of system transmitting parallel channels such as orthogonal frequency division multiplexing (OFDM) or orthogonal code division multiplexing (OCDM). The system subtracts a reference function to reduce peaks in a signal. The function is selected in such a way as to refrain from causing out-of-band interference. (Awater at Abstract).

C. Schenk

Schenk is directed to a circuit for reducing crest factor of a signal.

D. Henkel

Henkel is directed to a peak-to-average reduction technique that employs *reserved* carriers or "tone reservation" to transmit a time domain subtraction signal from a data signal. (See Henkel at Abstract and at col. 1)("The Dirac function δ would require the DFT frame and would thus not allow to transmit information anymore. The idea is now to reserve only some of the frequency bins and use them to generate a Dirac-like time-domain signal p that could be substracted iteratively from the *remaining carriers*...")

Thus, Henkel is directed to a special peak-to-average reduction technique that uses carriers that are not otherwise used for transmission of data.

E. The Proposed Combination

In the July 13, 2009 office action, no single reference was alleged to contain each and every element of claim 15 (which has now been incorporated into claim 8). Instead, the Office Action proposes a modification of Awater to incorporate features of Schenk and Henkel to address the features of claim 15. As will be discussed below in detail, however, there is no reason, suggestion or motivation to modify Awater with the teachings of Henkel (or Schenk) as proposed.

In essence, Awater and Henkel teach substantially different methods for reducing peak to average ratio in a signal. The proposed combination mixes implementation details of the two different methods that are not applicable to each other. For example, the incorporated teachings of Henkel are not applicable to the type of peak to average (PAR) reduction technique in Awater, and would not provide improvements thereto. Accordingly, one of ordinary skill in the art would not modify Awater to incorporate the teachings of Henkel as proposed.

1. Redundant and Non-Redundant PAR Reduction

Awater is directed to a *non-redundant* type of PAR reduction wherein a correction signal is generated on the basis of (i.e. in the same carriers as) the data signal. (See, e.g., Awater at col. 2, lines 6-9 and col. 3, lines 9-20). By contrast, Henkel (and the invention of claim 8) employ a *redundant* type of PAR reduction wherein different frequencies are used for the correction.

2. The Proposed Modification

In the rejection of claims 8 and 15, the Examiner admitted that Awater failed to disclose a plurality of limitations, including "at least one carrier being reserved which is not provided for the data transmission". (E.g., office action at p.4). To satisfy this shortcoming of Awater, the Examiner relies on the teachings of Schenk. In particular, the pertinent sections of the Office Action read as follows:

> Further the disclosure of Awater fails to explicitly disclose the limitation of at least on e carrier being reserved which is not provided for the data transmission. This method is however rendered obvious by the disclosure of Schenk. Schenk discloses where at least one carrier being reserved which is not provided for the data transmission (Col. 1 lines 48-60) as being a well known tactic in the area of multi-carrier communication as a means for providing an initial reduction to the crest factor. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to implement this well known method to provide further reduction of the crest factor of the multi-carrier signal.

(Office action at pp.4-5).

The Examiner further proposed modifying Atwater to include several steps taught by Henkel, which are directed to a redundant system, i.e., where only unused frequencies are used for PAR reduction. (*Id.* at p.6).

Applicants respectfully submit that the above-quoted paragraph is in error, or at least does not arrive at the claimed invention. In particular, the Examiner is correct that Schenk teaches that it is well known to use "unused" carrier frequencies for the purpose of reducing the crest factor of a signal. In other words, methods for reducing crest factor using unused frequencies (i.e. redundant methods) are well known. However, *Awater does not use such a method*, nor is it designed for such a method. Schenk does *not* teach how (or whether) to modify a non-redundant PAR reduction technique, such as taught in Awater, to become a

redundant PAR reduction technique, as necessarily to use "unused" carrier frequencies for reducing a crest factor.

The Schenk method, at best, teaches the use of a redundant method *instead* of non-redundant method. In other words, if one were to "modify" Awater to use a redundant method, as alleged, one of ordinary skill in the art would replace the *entire* Awater non-redundant method with a known redundant method. Schenk certainly does not in any way teach or suggest combining parts of non-redundant methods with parts of redundant methods of PAR reduction. Moreover, Schenk does not teach or suggest converting the non-redundant crest factor reduction method of Awater into a redundant method.

At best, Schenk may suggest *replacing* the Awater method with a redundant method such as that taught by Henkel. Such a replacement, however, would fail to include the method steps of Awater described on page 3 of the office action, because those steps are specific to Awater's non-redundant method, and issues raised by that method. Accordingly, it is respectfully submitted that the Examiner has not provided a reason for combining select steps of Awater with select steps of Schenk and/or Henkel.

Alternatively, the Examiner may be alleging that one of ordinary skill in the art would simply perform the Awater method on unused frequencies. (Office Action at p.4). This also appears to be the underpinning allegation with regard to claim 15, where steps of Henkel are incorporated into the method of Awater. (Office Action at p.6). However, none of the prior art suggest that it is feasible to perform the method of Atwater only on unused frequencies.

In the first place, there would be no reasonable expectation of success since redundant and non-redundant methods are so substantially different, and have different goals. In the

second place, Schenk does not teach that *all*, *most*, or even *some* non-redundant methods may be converted to redundant methods simply be performing them only on unused signal frequencies.

Accordingly, there is no reason that one of ordinary skill in the art would modify Awater to include the limitation of "at least one carrier being reserved which is not provided for the data transmission", nor to incorporate the additional steps taught by Henkel, which are specifically designed for use in a redundant system.

3. No Reason, Motivation or Suggestion Provided

Even if one were to apply the method of Awater on unused frequencies, the Office Action does not provide a clearly articulated reason, motivation or suggestion to modify Awater to include the steps of Henkel. In particular, in connection with the rejection of claim 15, the Examiner provided the following reasoning:

> Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate peak detections and reduction method as disclosed by Henkel within the combined crest factor reduction method disclosed by Awater and Schenk in order to gain the added benefit of further detail and efficiency in the peak reduction processing methods.

(Office Action at p.6). It is respectfully submitted that the above paragraph does not set forth a clearly articulated reason to modify Awater and Schenk with the teachings of Henkel. More specifically, the Office Action states that further "efficiency" may be accomplished by the combination of Atwater with Henkel. However, the prior art does not teach or suggest that a system similar to Awater may be made more efficient by incorporating the teachings of Henkel. The Office Action does not explain how the addition of the steps of Henkel as proposed would result in an increased efficiency in the operation of Awater.

Accordingly, it is respectfully submitted that the Office Action does not set forth a clearly articulated reason to modify Awater with the teachings of Henkel as proposed in connection with the rejection of claim 15. Because claim 15 has been incorporated into claim 8, it is respectfully submitted that the rejection of claim 8 over Awater, Schenk and Henkel should be withdrawn.

4. Conclusion as to Claim 8

For all of the foregoing reasons, it is respectfully submitted that claim 8, as amended to incorporate the limitations of claim 15, is allowable over the prior art of record.

IV. Claims 11-14

Claims 11-14 also stand rejected as allegedly being obvious over Awater, Schenk and Henkel. Claims 11-14 all depend from and incorporate all of the limitations of claim 8, as amended. As discussed above, there is no clearly articulated reason to combine Awater, Schenk and Henkel to arrive at the invention of claim 8, as amended. Accordingly, for at least the same reasons, there is no clearly articulated reason to combine those references to arrive at the inventions of dependent claims 11-14. It is therefore respectfully submitted that the obviousness rejections of claims 11-14 are in error and should be withdrawn.

V. Claims 16-19 and 21-23

Independent claim 16 stands rejected as allegedly being obvious over Awater. Claim 16 has been amended to incorporate the limitations of claims 20 and 24. Claim 24 stands

rejected as allegedly being obvious over Awater in view of Henkel. Claim 24 recites the use of a carrier signal that is not available for data transmission for generated a sample correction function. As discussed above in connection with claim 8, there is no clearly articulated reason, motivation or suggestion to modify Awater, which is a non-redundant PAR reduction method, with select portions of the redundant PAR reduction method of Henkel.

For at least this reason, it is respectfully submitted that claim 16 as amended to incorporate the limitations of claim 20 and 24 should be withdrawn. Claims 17-19 and 21-23 all depend from claim 16 and are therefore allowable for at least the same reasons.

VI. Conclusion

For all of the foregoing reasons, it is respectfully submitted the applicant has made a patentable contribution to the art. Favorable reconsideration and allowance of this application is therefore respectfully requested.

Respectfully submitted,

/Harold C. Moore/
Harold C. Moore
Attorney for Applicants
Attorney Registration No. 37,892
Maginot Moore & Beck
Chase Tower
111 Monument Circle, Suite 3250
Indianapolis, Indiana 46204-5109
Telephone: (317) 638-2922